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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/731,503	12/10/2003	Shye-Lin Wu	BHT-3167-170	4637

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BRUCE H. TROXELL
SUITE 1404
5205 LEESBURG PIKE
FALLS CHURCH, VA 22041

EXAMINER

FULK, STEVEN J

ART UNIT PAPER NUMBER

2891

DATE MAILED: 08/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/731,503

Applicant(s)

WU, SHYE-LIN

Examiner

Steven J. Fulk

Art Unit

2891

PMW

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) 1-5 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Invention II, claims 6-8, in the reply filed on July 22, 2005 is acknowledged.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The fourth sentence of claim 6 states "a pair of termination regions surrounded and spaced said pair of field oxide regions with a second mesa." The phrase "surrounded and spaced" is vague and indefinite as to the layout of the termination regions in relation to the field oxide regions.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Insofar as definite, Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. '996 in view of Wakatabe et al. '669.

Chang et al. discloses a power rectifier device using stripe trenches to increase surface area and enhance forward current capacity (col. 2, lines 48-52) comprising an n- drift layer formed on an n+ substrate (col. 2, lines 6-12), a cathode metal formed on the n+ substrate on a surface opposite the n- drift layer (col. 2, lines 43-47), a pair of termination field oxide regions formed into said n- drift layer with p-type regions beneath them (col. 2, lines 13-26), a first mesa separating the field oxide regions with trenches formed into the mesa to create grooves (col. 2, lines 31-37), a barrier metal layer formed of aluminum, platinum, or molybdenum on the sidewalls and bottom of the trenches and on the remnant portions of the mesa (col. 2, lines 38-43), and a top metal layer of titanium, nickel, silver, or a combination thereof forming an anode over the barrier metal and extended over the termination regions (col. 2, lines 43-47).

Chang et al. does not teach forming a second mesa surrounding the field oxide regions and first mesa region to form rectangular trenches to increase surface area. Wakatabe et al. teaches the use of either stripe trenches or rectangular trenches as a method of increasing surface area in a power rectifier device (col. 3, lines 19-22). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the

rectangular trench shape of Wakatabe et al. in the rectifier device of Chang et al. because Wakatabe et al. teaches that stripe trenches and rectangular trenches are functional equivalents in the performance of rectifier devices when increasing surface area to enhance forward current capacity (col. 3, lines 19-22; col. 6, lines 47-53).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
 - a. Hsu et al. '929 discloses a method of forming a trench Schottky diode and termination structure.
 - b. Chang et al. '033 and '541 disclose a Schottky diode and method of manufacturing a diode having increased surface area and improved reverse bias characteristics.
 - c. Tsui et al. '951 discloses a two mask trench Schottky diode.
 - d. Wu '614 discloses a high-speed two mask Schottky diode with high field breakdown.
7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571) 272-8323. The examiner can normally be reached on Monday through Friday, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

sjf
8/9/05



**B. WILLIAM BAUMEISTER
SUPERVISORY PATENT EXAMINER**